## Remarks

The Office Action mailed January 30, 2009, and made final, has been carefully reviewed and the foregoing amendment has been made in consequence thereof.

Claims 1-8, 11, 17, 18, 21-25, and 28-32 are now pending in this application. Claims 1-8, 11-18, and 21-25 are rejected. Claims 9, 10, 19, 20, 26, and 27 have previously been canceled, although Claims 9, 10, 19, and 20 are indicated as being withdrawn at page 1 of the Office Action. Claims 12-16 are canceled herein. Claims 28-32 are newly added. No additional fee is due for newly added Claims 28-32. No new matter has been added.

The rejection of Claims 1, 6, 7, 11, 16, 17, 21, 22, and 24 under 35 U.S.C. § 103(a) as being unpatentable over Okerlund (U.S. Pat. No. 6,526,117) (hereinafter referred to as "Okerlund") in view of Mostafavi "Overview of Post-Processing Algorithm to Create Volumetric Motion Sequences" (hereinafter referred to as "Mostafavi") is respectfully traversed.

Okerlund describes a method for generating an optimally registered working set of computer tomography images. A Region of Interest, or a ROI, (43) is divided into separate sub-volumes (122, 124 ...134) that each correspond to a diastolic phase (DP) of a patient. Each separately acquired image set (106, 108...118) corresponds to one of the sub-volumes (122, 124...134) such that each image set (106, 108...118) corresponds to the diastolic phase (DP). A system operator selects a specific phase point (SP) from within the diastolic phase (DP) at which an image reconstructor (68) should create transaxial slice images. The reconstructor (68) retrieves a sub-set of image data corresponding to a phase range ($\Psi_N$) centered on the phase location (SP) to generate a transaxial slice image set (106($\Psi_N$), 108($\Psi_N$)...118($\Psi_N$)). Each transaxial slice image set (106($\Psi_N$), 108($\Psi_N$)...118($\Psi_N$)) corresponds to one of the ROI sub-volumes (122, 124...134).

To facilitate aligning the transaxial slice image sets (106($\Psi_N$), 108($\Psi_N$)...118($\Psi_N$)), the diastolic phase (DP) is sub-divided into separate phase ranges ($\Psi_{N-2}$, $\Psi_{N-1}$, $\Psi_N$, $\Psi_{N+1}$, $\Psi_{N+2}$), where one phase dependent image slice data set (112($\Psi_{N-2}$), 112($\Psi_{N-1}$), 112($\Psi_N$), 112($\Psi_{N+1}$), 112($\Psi_{N+2}$)) corresponds to a respective phase range ($\Psi_{N-2}$, $\Psi_{N-1}$, $\Psi_N$, $\Psi_{N+1}$, $\Psi_{N+2}$). The acquired image sets (106, 108...118) corresponding to adjacent ROI sub-volumes (122, 124 ...134) are compared to identify an optimal working set that includes a separate acquired image set (106, 108...118) that corresponds to a respective ROI sub-volume (122, 124 ...134). A phase dependent image slice image set (112($\Psi_{N-2}$), 112($\Psi_{N-1}$), 112($\Psi_{N+1}$), 112($\Psi_{N+2}$)) from another phase within the sub-volume image set (106, 108...118) is substituted for a misaligned image set (112($\Psi_N$)) to facilitate increasing the diagnostic characteristics of an optimal working image set such that the optimal set includes image sets (106, 108...118) taken at different phase ranges ($\Psi_{N-2}$, $\Psi_{N-1}$, $\Psi_N$, $\Psi_{N+1}$, $\Psi_{N+2}$). Notably, Okerlund does not describe or suggest specifying at least one target phase in a physiological cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sorting the generated image based on the target phase to generate at least one set of images.

Mostafavi describes a post processing algorithm to create volumetric motion sequences. Images are grouped into sequential "time bins" based on scan times, and phase column entries for the images in a time bin are averaged to create a bin phase. A confidence number is assigned to each bin phase based on a number of images in a time bin. An average delta phase from one time bin to the next time bin is calculated. The average delta phase is used to calculate a phase bin interval. An average phase of each time bin is calculated based on the phases of the images within each time bin and the phase bin interval of each time bin. The average phase for a time bin is assigned to each image in the time bin. Notably, Mostafavi does not describe or suggest using the average delta phase to specify at least one target phase for use in sorting the images. Rather, the images are sorted into time bins before the average delta phase is calculated.

Claim 1 recites a method for retrospective internal gating, said method comprising "scanning a patient to obtain projection data . . . generating images from the projection data . . . obtaining a signal representing information regarding a physiological cycle of motion of an object within the patient . . . associating a plurality of sample points of the physiological cycle with each of the generated images, each plurality of sample points associated with phases of the physiological cycle . . . calculating a phase of each of the generated images based on an average of the phases of a respective plurality of sample points associated with each of the generated images . . . specifying at least one target phase in the physiological cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of the generated images . . . and sorting the generated images based on the at least one target phase to generate at least one set of images."

Neither Okerlund nor Mostafavi describe or suggest a method for retrospective internal gating as recited in Claim 1. More specifically, neither Okerlund nor Mostafavi describe or suggest a method that includes specifying at least one target phase in a physiological cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sorting the generated image based on the target phase to generate at least one set of images. Rather, in contrast to the present invention Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Okerlund in view of Mostafavi.

Claims 6 and 7 depend from independent Claim 1. When the recitations of Claims 6 and 7 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 6 and 7 likewise are patentable over Okerlund in view of Mostafavi.

Claim 11 recites a system for imaging a moving object within a patient, the system comprising "a scanner configured to acquire projection data of the patient . . . an image reconstructor configured to generate images corresponding to the projection data . . . and a controller configured to . . . receive a signal representing information regarding a cycle of motion of the object . . . receive generated images from said image reconstructor . . . associate a plurality of sample points of the cycle of motion with each of the generated images, each plurality of sample points associated with phases of the cycle of motion . . . calculate a phase of each of the generated images based on an average of the phases of a respective plurality of sample points associated with each of the generated images . . . enable a user to specify at least one target phase within the cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of the generated images . . . and sort the generated images based on the at least one target phase to generate at least one set of images."

Neither Okerlund nor Mostafavi describe or suggest a system for imaging a moving object as recited in Claim 11. More specifically, neither Okerlund nor Mostafavi describe or suggest a system that includes a controller configured to enable a user to specify at least one target phase within a cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sort the generated images based on the target phase to generate at least one set of images. Rather, in contrast to the present invention, Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin.

Accordingly, for at least the reasons set forth above, Claim 11 is submitted to be patentable over Okerlund in view of Mostafavi.

Claims 16 and 17 depend from independent Claim 11. When the recitations of Claims 16 and 17 are considered in combination with the recitations of Claim 11, Applicants submit that Claims 16 and 17 likewise are patentable over Okerlund in view of Mostafavi.

Claim 21 recites a system for imaging a moving object within a patient, the system comprising "a computed tomography (CT) scanner configured to acquire projection data of the patient . . . an image reconstructor coupled to the CT scanner and configured to generate images corresponding to the projection data . . . and a controller coupled to the image reconstructor and configured to . . . receive a signal representing information regarding a cycle of motion of the object . . . receive generated images from said image reconstructor . . . associate a plurality of sample points of the cycle of motion with each of the generated images, each plurality of sample points associated with phases of the cycle of motion . . . calculate a phase of each of the generated images based on an average of the phases of a respective plurality of sample points associated with each of the generated images . . . enable a user to specify at least one target phase within the cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of the generated images . . . and sort the generated images based on the at least one target phase to generate at least one set of images."

Neither Okerlund nor Mostafavi describe or suggest a system for imaging a moving object as recited in Claim 21. More specifically, neither Okerlund nor Mostafavi describe or suggest a system that includes a controller coupled to the image reconstructor and configured to enable a user to specify at least one target phase within a cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sort the generated images based on the target phase to generate at least one set of images. Rather, Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin.

Accordingly, for at least the reasons set forth above, Claim 21 is submitted to be patentable over Okerlund in view of Mostafavi.

Claim 22 recites a computer configured to "instruct a scanner to acquire projection data of the patient . . . instruct an image reconstructor to generate images corresponding to the projection data . . . receive a signal representing information regarding a cycle of motion of the object . . . receive generated images from the image reconstructor . . . associate a plurality of sample points of the cycle of motion with each of the generated images, each plurality of sample points associated with phases of the cycle of motion . . . calculate a phase of each of the generated images based on an average of the phases of a respective plurality of sample points associated with each of the generated images . . . enable a user to specify at least one target phase within the cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of the generated images . . . and sort the generated images based on the at least one target phase to generate at least one set of images."

Neither Okerlund nor Mostafavi describe or suggest a computer as recited in Claim 22. More specifically, neither Okerlund or Mostafavi describe or suggest a computer configured to enable a user to specify at least one target phase within a cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sort the generated images based on the target phase to generate at least one set of images. Rather, Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin.

Accordingly, for at least the reasons set forth above, Claim 22 is submitted to be patentable over Okerlund in view of Mostafavi.

Claim 24 recites a computer-readable medium encoded with a program configured to "instruct a scanner to acquire projection data of the patient . . . instruct an image reconstructor to generate images corresponding to the projection data . . . receive a signal representing information regarding a cycle of motion of the object . . . receive generated images from the image reconstructor . . . associate a plurality of sample points of the cycle of motion with each of the generated images, each plurality of sample points associated with phases of the cycle of motion . . . calculate a phase of each of the generated images based on an average of the phases of a respective plurality of sample points associated with each of the generated images . . . enable a user to specify at least one target phase within the cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of the generated images . . . and sort the generated images based on the at least one target phase to generate at least one set of images."

Neither Okerlund nor Mostafavi considered alone or in combination describe or suggest a computer-readable medium as recited in Claim 24. More specifically, neither Okerlundnor nor Mostafavi describe or suggest a program configured to enable a user to specify at least one target phase within a cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sort the generated images based on the target phase to generate at least one set of images. Rather, Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin.

Accordingly, for at least the reasons set forth above, Claim 24 is submitted to be patentable over Okerlund in view of Mostafavi.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1, 6, 7, 11, 16, 17, 21, 22, and 24 be withdrawn.

The rejection of Claims 2-5, 8, 12-15, 18, 23, and 25 under 35 U.S.C. § 103(a) as being unpatentable over Okerlund in view of Mostafavi and Kaufman et al. (U.S. Pat. No. 7,006,862) (hereinafter referred to as "Kaufman") in further view of Heuscher et al. (U.S. Pub. No. 2003/0007593) (hereinafter referred to as "Heuscher") is respectfully traversed.

Okerlund and Mostafavi are described above. Kaufman describes a gating method used to select a plurality of images that are obtained during diastole. More specifically, heart frequency information is used, along with information obtained with a plurality of derivative filters, to obtain time and phase information for generating an image in which a heart is at its largest volume.

Heuscher describes a computed tomography imaging method. In the method, electrocardiograph (ECG) data is analyzed (108) to identify a number of cardiac cycles corresponding to a selected number of cardiac cycles (106), and to identify a temporal point in each cardiac cycle corresponding to an occurrence of a selected cardiac state (110).

Claims 2-5, and 8 depend from independent Claim 1, which is recited above.

None of Okerlund, Mostafavi, Kaufman, and Heuscher, considered alone or in combination, describes or suggests a method for retrospective internal gating as recited in Claim 1. More specifically, none of Okerlund, Mostafavi, Kaufman, and Heuscher, considered alone or in combination, describes or suggests a method that includes specifying at least one target phase in a physiological cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sorting the generated image based on the target phase to generate at least one set of images. Rather, Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin. Kaufman describes generating an image in which a heart is at its largest volume by obtaining time and phase information, and Heuscher describes identifying a number of cardiac cycles corresponding to a selected number of cardiac cycles and identifying a temporal point in each cardiac cycle corresponding to an occurrence of a selected cardiac state by analyzing electrocardiograph data.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Okerlund in view of Mostafavi and Kaufman, in further view of Heuscher.

When the recitations of Claims 2-5, and 8 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2-5, and 8 likewise are patentable over Okerlund in view of Mostafavi and Kaufman, in further view of Heuscher.

Claims 12-15, and 18 depend from independent Claim 11, which is recited above.

None of Okerlund, Mostafavi, Kaufman, and Heuscher, considered alone or in combination, describes or suggests a system for imaging a moving object as recited in Claim 11. More specifically, none of Okerlund, Mostafavi, Kaufman, and Heuscher, considered alone or in combination, describes or suggests a system that includes a controller configured to enable a user to specify at least one target phase within a cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sort the generated images based on the target phase to generate at least one set of images. Rather, Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin. Kaufman describes generating an image in which a heart is at its largest volume by obtaining time and phase information, and Heuscher describes identifying a number of cardiac cycles corresponding to a selected number of cardiac cycles and identifying a temporal point in each cardiac cycle corresponding to an occurrence of a selected cardiac state by analyzing electrocardiograph data.

Accordingly, for at least the reasons set forth above, Claim 11 is submitted to be patentable over Okerlund in view of Mostafavi and Kaufman, in further view of Heuscher.

When the recitations of Claims 12-15, and 18 are considered in combination with the recitations of Claim 11, Applicants submit that dependent Claims 12-15, and 18 likewise are patentable over Okerlund in view of Kaufman, in further view of Heuscher.

Claim 23 depends from Claim 22, which is recited above.

None of Okerlund, Mostafavi, Kaufman, and Heuscher, considered alone or in combination, describes or suggests a computer as recited in Claim 22. More specifically, none of Okerlund, Mostafavi, Kaufman, and Heuscher, considered alone or in combination, describes or suggests a computer configured to enable a user to specify at least one target phase within a cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sort the generated images based on the target phase to generate at least one set of images. Rather, Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin. Kaufman describes generating an image in which a heart is at its largest volume by obtaining time and phase information, and Heuscher describes identifying a number of cardiac cycles corresponding to a selected number of cardiac cycles and identifying a temporal point in each cardiac cycle corresponding to an occurrence of a selected cardiac state by analyzing electrocardiograph data.

Accordingly, for at least the reasons set forth above, Claim 22 is submitted to be patentable over Okerlund in view of Mostafavi and Kaufman, in further view of Heuscher.

When the recitations of Claim 23 are considered in combination with the recitations of Claim 22, Applicants submit that dependent Claim 23 likewise is patentable over Okerlund in view of Kaufman, in further view of Heuscher.

Claim 25 depends from independent Claim 24, which is recited above.

None of Okerlund, Mostafavi, Kaufman, and Heuscher, considered alone or in combination, describes or suggests a computer-readable medium as recited in Claim 24. More specifically, none of Okerlund, Mostafavi, Kaufman, and Heuscher, considered alone or in combination, describes or suggests a computer-readable medium encoded with a program configured to enable a user to specify at least one target phase within a cycle of motion by calculating an average delta phase that is an average of phase differences between consecutive images of generated images, and sort the generated images based on the target phase to generate at least one set of images. Rather, Okerlund describes substituting a phase dependent image slice image set from another phase within a sub-volume image set is substituted for a misaligned image set to facilitate increasing diagnostic characteristics of an optimal working image set such that the optimal set includes image sets taken at different phase ranges. Mostafavi describes sorting images into time bins then calculating an average delta phase from one time bin to the next time bin. Kaufman describes generating an image in which a heart is at its largest volume by obtaining time and phase information, and Heuscher describes identifying a number of cardiac cycles corresponding to a selected number of cardiac cycles and identifying a temporal point in each cardiac cycle corresponding to an occurrence of a selected cardiac state by analyzing electrocardiograph data.

Accordingly, for at least the reasons set forth above, Claim 24 is submitted to be patentable over Okerlund in view of Mostafavi and Kaufman, in further view of Heuscher.

When the recitations of Claim 25 are considered in combination with the recitations of Claim 24, Applicants submit that dependent Claim 25 likewise is patentable over Okerlund in view of Msotafavi and Kaufman, in further view of Heuscher.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 2-5, 8, 12-15, 18, 23, and 25 be withdrawn.

Newly added Claims 28-32 depend indirectly from independent Claim 11, which Applicants submit is patentable over the cited art. For at least the reasons set forth above, Applicants respectfully submit that Claims 28-32 are also patentable over the cited art.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action are respectfully solicited.

Respectfully submitted,

William J. Zychlewicz
Registration No. 51,366
ARMSTRONG TEASDALE LLP
One Metropolitan Square, Suite 2600
St. Louis, Missouri 63102-2740
(314) 621-5070